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Variation in Delivery of the 10 Essential Public Health Services by Local Health Departments for Obesity Control in 2005 and 2008

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Abstract

Objectives—To describe and compare the capacity of local health departments (LHDs) to perform 10 essential public health services (EPHS) for obesity control in 2005 and 2008, and explore factors associated with provision of these services.

Methods—The data for this study were drawn from the 2005 and 2008 National Profile of Local Health Department surveys, conducted by the National Association of County and City Health Officials. Data were analyzed in SAS version 9.1 (SAS Institute Inc, Cary, North Carolina).

Results—The proportion of LHDs that reported that they do not provide any of the EPHS for obesity control decreased from 27.9% in 2005 to 17.0% in 2008. In both 2005 and 2008, the 2 most frequently provided EPHS for obesity control by LHDs were informing, educating, and empowering the people (EPHS 3) and linking people to needed personal health services (EPHS 7). The 2 least frequently provided services were enforcing laws and regulations (EPHS 6) and conducting research (EPHS 10). On average, LHDs provided 3.05 EPHS in 2005 and 3.69 EPHS in 2008. Multiple logistic regression results show that LHDs with larger jurisdiction population, with a local governance, and those that have completed a community health improvement plan were more likely to provide more of the EPHS for obesity ($P < .05$).

Conclusions—The provision of the 10 EPHS for obesity control by LHDs remains low. Local health departments need more assistance and resources to expand performance of EPHS for obesity control. Future studies are needed to evaluate and promote LHD capacity to deliver evidence-based strategies for obesity control in local communities.

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Keywords

essential public health services; local health department; obesity control

Recent data show that 33.8% of men and 35.5% of women were obese in the United States in 2007–2008.[1] The prevalence of obesity and overweight increased rapidly in the United States in the past 3 decades. From 1987 to 2007, the fraction of adults who were overweight or obese increased from 44% to 63%; almost two thirds of the adult population now falls into one of those categories.[2,3] If this trend continues, it is estimated that 75% of US adults will be overweight or obese by the year 2015.[4] Obesity could lead to many chronic conditions, including diabetes, hypertension, stroke, heart disease, certain cancers, and arthritis.[5,6] Chronic diseases are the leading causes of disability and account for 7 of 10 deaths in the United States.[7]

The obesity epidemic is also one of the leading drivers of health care costs. Per capita spending for obese adults is far higher compared with spending for normal-weight adults. In fact, that difference rose from 8% in 1987 to 38% in 2007. Spending in 2007 on obesity-related diseases averaged $2030 for obese adults and $1090 for normal-weight adults, a difference of $940.[8] Public health agencies including local health departments (LHDs) are challenged with the additional responsibility of chronic disease prevention and control.[7] Better understanding of LHDs' capacity to deliver essential public health services (EPHS) may be essential for controlling the growing burden and cost of obesity. Success in fighting the obesity epidemic at least partially depends on ability of LHDs to deliver obesity-control services. A *local health department* is "an administrative or service unit of local or state government concerned with health and carrying some responsibility for the health of a jurisdiction smaller than the state."[9,10] Local health departments are the core of public health infrastructure that provides the resources and networks necessary to carry out these public health services.[11] The 10 EPHS framework, which defines the public health activities that ideally should be undertaken in all communities, was developed in 1994 by the Public Health Functions Steering Committee that was chaired by the Surgeon General and included representatives from public health agencies and national public health organizations.[12] The concept of 10 essential services has been endorsed by the Institute of Medicine in its seminal 1988 report about the future of public health.[13] The framework of the 10 EPHS is the basis for the National Public Health Performance Standards Program. The goals of the program are to provide performance standards for public health systems and encourage their widespread use; encourage and leverage national, state, and local partnerships to build a stronger foundation for public health preparedness; promote continuous quality improvement of public health systems; and strengthen the science base for public health practice improvement.[14] Moreover, it has become a useful tool in assessing performance of public health programs, such as diabetes prevention and control,[15] and public health agencies' emergency preparedness.[16] Our study is designed to assess capacity of LHDs to provide obesity control and prevention services using the 10 EPHS framework.

Previous studies have suggested that greater local health agency capacity (eg, budget and staff) was associated with better implementation of public health services[17–19] and

community health outcomes.[20] In addition, previous studies have investigated overall level of provision of obesity prevention and control in jurisdictions,[21,22] but little is known about what types of services have been provided and whether there are any changes in provision of these services over time. The objectives of this study are to describe and compare the provision of the 10 EPHS for obesity control by LHDs in 2005 and 2008 and explore factors that are associated with providing these services. The results of our study can be used to identify which of the 10 EPHS in obesity control are less frequently performed in local communities so that necessary technical assistance and resources can target those areas. This study also provides insights into how to best strengthen LHD capacities to deliver the 10 EPHS.

Methods

Data source and study sample

We used data from the National Profile of Local Health Departments (the Profile) in 2005 and 2008 conducted by the National Association of County and City Health Officials. The Profile provides a comprehensive account of LHD infrastructure and practice in the United States, including information on type of jurisdiction served, governance, financing, demographic characteristics of agency director and other workforce, and types of activities and services provided by LHDs.[9,10] A core questionnaire was sent to 2864 LHDs in 2005 and 2794 LHDs in 2008 in all states, except Rhode Island in 2005 and Rhode Island and Hawaii in 2008. In addition, 3 separate Profile Module questionnaires were sent to samples of LHDs, which were selected by a stratified random sampling (without replacement), with strata defined by jurisdiction population size.[9,10] The Module 3 questionnaire contained questions on the 10 EPHS for obesity control, the source of primary variables in this study. It was sent to a sample of 519 LHDs in 2005 and 547 LHDs in 2008. A total of 423 and 454 LHDs responded to the Module 3 surveys in 2005 and 2008, respectively, with response rates of 81% and 83%, respectively.[9,10]

Measures

Outcome variables—In the Module 3 of the 2005 and 2008 Profile surveys, LHD leadership were asked the following question about whether their LHDs provided a set of 10 EPHS for obesity control in the past year:[9,10] “The chart below shows the ten essential public health services and six public health program areas in which these services might be applied. For each program area, go down the column and check each service which your LHD has employed in support of that program area during the past year.” Each essential service for the obesity control program area was measured and coded as a dichotomous variable (yes/no).

Covariates

Following previous research on LHD performance,[18,19,23,24] we included variables that describe LHDs’ jurisdictional and organizational characteristics as covariates in this study. The jurisdictional characteristic variables included the following: (1) jurisdiction population size; (2) jurisdiction type—county, city or township, or combined county-city or multicounty;[24] and (3) type of governance—local governance or state governance.[9]

The organizational characteristic variables included the following: (1) presence of a local board of health (yes/no); (2) annual LHD expenditure per capita—total LHD public health expenditure divided by the total jurisdiction population; (3) number of LHD employees in full-time equivalents (FTEs) per 100 000 people in the jurisdiction (the natural logarithmic scale was used for the expenditure per capita and FTEs per 100 000 population variables to reduce their skewedness and improve model fit in the multivariate analyses); (4) characteristics of the LHD director, including full-time employment (yes/no), length of tenure as LHD director (years), sex, and having a graduate degree (yes/no); and (5) other LHD characteristics, such as running a chronic disease surveillance program (yes/no), completion of a community health assessment in past 3 years (yes/no), and completion of a community health improvement plan in the past 3 years (yes/no).

County-level obesity prevalence was included to examine the association between obesity burden (a proxy measure of demand for services) and the supply of the 10 EPHS for obesity control. The obesity prevalence data for adults (18 years and older) for 2007[25] were obtained from CDC and merged with the 2008 profile survey data using Federal Information Processing Standards codes.

Statistical analysis

We first computed the proportion of LHDs that provided each of the 10 EPHS for obesity control in 2005 and 2008. Next, we explored associations between an LHD's jurisdiction and organizational characteristics and provision of the 10 EPHS for obesity control by running separate multivariate logistic regressions using the 2008 profile survey data. The variable "Enforce laws and regulations" (EPHS 6) was excluded from analysis because of a small number of responses. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each variable and parameter. Results were considered statistically significant if $P < .05$. Analyses were conducted using SURVEYFREQ, SURVEYMEANS, and SURVEYLOGISTIC procedures in SAS version 9.1 (SAS Institute Inc, Cary, North Carolina). These procedures account for the complex sampling strategy applied in the survey and allow for obtaining nationally representative estimates of parameters of interest.

Results

Figure 1 displays the proportion of LHDs conducting the 10 EPHS for obesity control. The level of provision of each of the 10 EPHS by LHDs varied significantly in 2005 and 2008. In both years, the top 2 most frequently provided EPHS for obesity control by LHDs were informing, educating, and empowering the people (EPHS 3) and linking people to needed personal health services (EPHS 7), whereas the bottom 2 services were enforcing laws and regulations (EPHS 6) and conducting research (EPHS 10).

Between 2005 and 2008, there was an overall increase in the proportion of LHDs providing each of the 10 EPHS for obesity control, although the increase was uneven by type of service. For example, the proportion of LHDs monitoring health status (EPHS 1) increased from 30.2% in 2005 to 50.0% in 2008 ($P < .001$), the largest increase among the 10 EPHS, whereas the proportion of LHDs developing policies and plans for obesity control (EPHS 5) changed from 31.0% in 2005 to 32.7% in 2008 ($P = .61$), the smallest increase (Figure 1).

The proportion of LHDs that did not provide any of the EPHS for obesity control decreased from 27.9% in 2005 to 17.0% in 2008 (P <.001), whereas the proportion of LHDs that provided 7 to 10 EPHS increased from 15.6% in 2005 to 21.0% in 2008 (P = .06). On average, LHDs provided slightly more EPHS for obesity control in 2008 than in 2005: a mean of 3.69 EPHS (95% CI: 3.38–4.00) in 2008 compared with 3.05 EPHS (95% CI: 2.76–3.33) in 2005 (P = .03) (Table 1).

Using the 2008 profile survey data, we examined the provision of the 10 EPHS by LHDs' jurisdiction population size, categorized as less than 25 000, 25 000 to 49 999, 50 000 to 99 999, 100 000 to 499 999, and 500 000 or more. As shown in Figure 2, LHDs with a larger jurisdiction population were more likely to provide more of the 10 EPHS for obesity control. For example, 52.5% of LHDs serving a population of 500 000 or more provided 7 to 10 EPHS, whereas 16.5% of LHDs servicing a population less than 25 000 provided 7 to 10 EPHS in 2008.

We also explored bivariate associations of LHDs' jurisdictional and organizational characteristics with provision of 9 of the EPHS for obesity control (excluding EPHS 6) with the 2008 profile survey data. Bivariate results (Table 2) show that population size, per capita expenditure, having a full-time director, running a chronic disease surveillance system, having completed a community health assessment, and having completed a health improvement plan were significantly associated with provision of more of the EPHS. However, LHDs with a board of health were less likely to provide EPHS 4 (mobilize partnerships) and EPHS 5 (develop policies and plans).

Results of multivariate logistic regression analysis of the 2008 profile survey data are presented in Table 3. Three LHD characteristics—population size, local governance, and completion of health improvement plan—were significantly associated with providing 3 or more of the 9 EPHS for obesity control examined in this study. That is, population size was significantly associated with EPHS 2, 3, 4, and 9 (all P < .05), with strongest association with mobilizing partnerships (EPHS 4) (OR = 1.58, 95% CI: 1.21–2.05). Local governance was significantly associated with EPHS 1, 5, and 9. Completion of a health improvement plan was significantly associated with 8 of the 9 EPHS (ie, except EPHS 10) for obesity control (all P < .05). Completion of a health assessment was significantly associated with monitoring health status (EPHS 1) (OR = 3.20, 95% CI: 1.49–6.87) and mobilizing partnerships (EPHS 4) (OR = 2.33, 95% CI: 1.10–4.91).

Other LHD characteristics positively associated with provision of 1 EPHS included jurisdiction type, per capita expenditure, LHD FTEs, and LHD director's tenure. However, having local board of health in a jurisdiction was associated with the decreased odds of developing policies and plans (EPHS 5) (OR = 0.39, 95% CI: 0.17–0.90). The obesity prevalence level was associated with monitoring health status (EPHS 1) (OR = 1.12, 95% CI: 1.02–1.22) (Table 3).

Discussion

Our study described the capacity of LHDs to deliver the 10 EPHS for obesity control, examined changes between 2005 and 2008 in provision of those services, and explored factors that are associated with providing each of the EPHS. The results indicate that provision of the 10 EPHS by LHDs varied widely by LHD characteristics. In addition, on average, a significantly greater number of EPHS were provided by LHDs in 2008 than in 2005. This trend is consistent with the general economic realities of the country wherein 2005 to 2008 was a period of modest growth in LHDs' capacities, which was evidenced by an increase in LHDs' budgets and staff.[26] Our results suggest the following implications for public health practice related to obesity control.

The provision of the 10 EPHS for obesity control by LHDs needs to be improved. Although our study results indicate that LHDs increased their efforts in obesity control in their communities from 2005 to 2008, there were only some improvements in services, such as developing policies and plans (EPHS 5) and workforce training (EPHS 8). A previous study reported that public health workers felt that they need more training in policy development and analytical competencies.[27] Moreover, our results also reveal that some EPHS were not commonly provided by LHDs. For example, 6 of the 10 EPHS were provided by less than 50% of LHDs in 2008. Furthermore, our results provide evidence that performance of developing policies and plans (EPHS 5) and enforcement of laws and regulations (EPHS 6) was lower. In both 2005 and 2008, only about one third of LHDs were developing policies and plans for obesity control (EPHS 5), and less than 4% of LHDs were involved in enforcing laws and regulations (EPHS 6) related to obesity control in their jurisdictions. Policy intervention strategies have been proven to be effective in other public health practices, such as tobacco control.[28] Moreover, to reverse the obesity epidemic, policy and environmental interventions have been universally accepted and proposed as complementary strategies.[29,30] Currently, CDC provides funding and technical assistance to states and communities to address the problem of obesity. Programs such as the Communities Putting Prevention to Work program and the state-based Nutrition and Physical Activity Program to Prevention Obesity and Other Chronic Diseases are examples of the environment- and policy-based approaches to supporting better diet and physical activity in states and communities.[5] In 2009, the CDC recommended 24 strategies for policy and environmental changes to help communities to control the obesity epidemic.[31] The fact that LHDs are lagging in provision of EPHS 5 and EPHS 6 means that additional efforts are needed to promote policy and enforcement strategies for obesity control in communities.

Local health departments in larger jurisdictions (eg, larger population size) are more likely to provide more EPHS for obesity control. Local health departments operating in jurisdictions with a population of more than 500 000 were more likely to provide more EPHS ($P < .05$). In addition, population size was also associated with EPHS 1 and EPHS 5 ($P < .1$). These findings are consistent with previous studies that suggest that jurisdiction population size is an important correlate of provision of public health services.[18,19,32,33] For example, Turnock et al[33] found that health departments serving a population of more than 50 000 reported better performance in the 10 EPHS in a national sample of 425 LHDs.

Local health departments with more staff and higher per capita expenditure are associated with greater provision of some but not all EPHS. Our results show that the LHD FTEs-to-population ratio was significantly associated with EPHS 3 (informing, educating, and empowering the people), whereas expenditure per capita was associated with EPHS 5 (developing policies and plans). Previous studies reported that greater resources are associated with higher performance.[17,19,23] For example, Mays et al[23] found that LHD spending per capita was a significant predictor of provision of all the 10 EPHS in an evaluation of public health system performance. Our finding that per capita expenditure was significant for only 1 EPHS for obesity control could suggest competition for funding for different programs at LHDs. Nevertheless, our results may suggest that increasing funding and hiring more staff may be a feasible strategy to increase the number of LHDs delivering these underperformed services. In addition, obesity prevalence level is positively associated only with provision of EPHS 1 (monitoring health status) by LHDs, but not with any other EPHS. Monitoring obesity is a more prevalent activity in jurisdictions with higher obesity rates. The insignificant relationship between obesity prevalence and provision of other EPHS programs underscores the need for improvements in implementing more programs for obesity control. Although it is beyond the scope of this study to evaluate the impact of funding and providing EPHS for obesity control on obesity prevalence in the jurisdictions, it remains an important area for future research.

Local health departments that have been engaged in community health assessments and completed community health improvement plan are more likely to provide EPHS. During a community health assessment, LHD staff and partners usually collect and assess information on a broad spectrum of a community's health and well-being indicators. Community health improvement planning helps to improve the community's overall health and well-being by identifying most important public health problems and gaps in available resources.[10] In 2008, approximately 63% of LHDs completed a community health assessment and approximately 49% completed a community health improvement plan in the past 3 years.[9] Our study results show that LHDs that completed health assessments and developed health improvement plans were almost twice more likely to provide EPHS in obesity control than LHDs that did not engage in these activities. This could suggest that community health assessment and health improvement planning help LHDs to prioritize health programs according to community needs. It may mean that promoting community health assessment and planning activities at LHDs may be a feasible strategy in bridging existing gaps in provision of EPHS for obesity control.

Local health department director characteristics (being full-time director, tenure, sex) are significantly associated with performance of some EPHS. Local health departments with a full-time director are more likely to perform all EPHS, except for EPHS 10 (research) (Table 2). The director's tenure is positively associated with provision of EPHS 9 (evaluation). In general, these results are consistent with previous studies.[18,33] Interestingly, LHDs with a female director were more likely to conduct evaluation of obesity control programs (EPHS 9). An earlier report also showed LHDs had higher performance if they had a female director.[17] Our results also show that having a board of health in a jurisdiction decreased the odds of developing policies and plans for obesity control (EPHS 5), but was not correlated with any other EPHS. Yet, previous studies reported that having a board of health was

associated with higher performance of LHDs.[17,19] For example, Mays et al[19] found that more public health activities were performed in jurisdictions with policy making boards of health than in jurisdictions without such entities.

The type of jurisdiction and type of governance influence the provision of EPHS for obesity control. For example, LHDs serving combined county/city or multicounty jurisdictions were more likely to develop policies and plans (EPHS 5) than those serving single counties. One possible explanation is that these LHDs might possess more expertise in implementing EPHS 5 than those serving single counties. Local health departments with local governance were more likely to provide 3 of the 10 services (EPHS 1, 5, and 9). These results appear to provide some evidence that a local governance structure seems to be associated with better performance of EPHS than a centralized governance structure. However, there is no consensus in the literature as to which governance structure performs better. One theory maintains that decentralization may be more responsive to community needs,[34,35] while another theory suggests that centralization may be more efficient and effective because central government can better coordinate resources and programs.[36]

Several limitations of this study should be noted. First, the results were based on LHDs' self-reported data. Local health departments may have overestimated or underestimated some of their EPHS activities. Second, only presence or absence of an activity was reported in the survey data. Information such as the scope or quality of each activity was not measured. Thus, we could not measure the intensity of the program. Third, we did not include other factors that could have influenced the performance of EPHS, such as social and economic status of the community.[37] Fourth, the 10 EPHS may not include all potential indicators that are relevant to measurements and evaluation of the performance of obesity control programs by LHDs. The reliability and validity of the 10 EPHS measures need to be further inspected. Fifth, the study was focused on exploring associations between LHD characteristics and provision of EPHS, and thus does not claim any causal relationships between the 2.

Conclusions

We found that the performance of the 10 EPHS for obesity control varied widely across LHDs. The gap in provision of the 10 EPHS for obesity control relative to the benchmarks of the National Association of County and City Health Officials operational definition of a functional health department is substantial. The operational definition of a functional LHD states "what people in any community can reasonably expect from their local governmental public health presence. It sets forth a series of standards based on the Ten Essential Public Health Services and serves as the framework for the standards of the national voluntary accreditation program operated by the Public Health Accreditation Board (PHAB)."[38] Local health departments, especially ones in smaller jurisdictions, need more technical assistance and resources to expand performance of EPHS for obesity control. Future studies are needed to evaluate and promote LHD capacity to deliver evidence-based strategies for obesity control in local communities.

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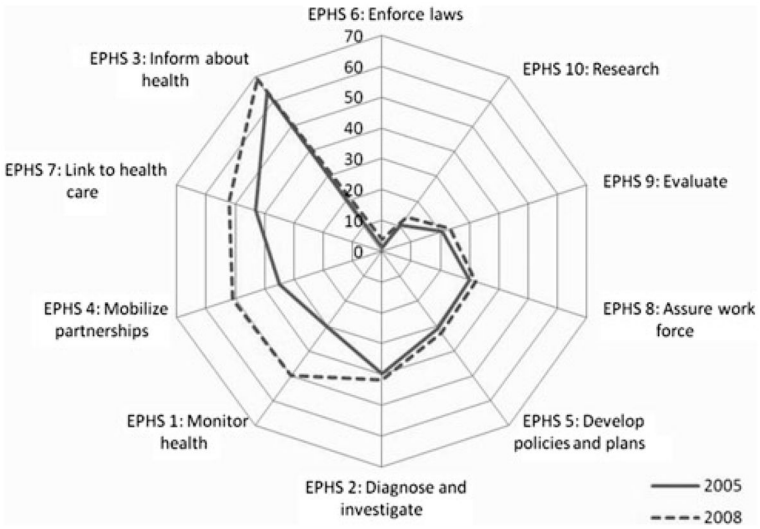

FIGURE 1.

Proportion of Local Health Departments Conducting 10 Essential Public Health Services for Obesity Control in 2005 and 2008

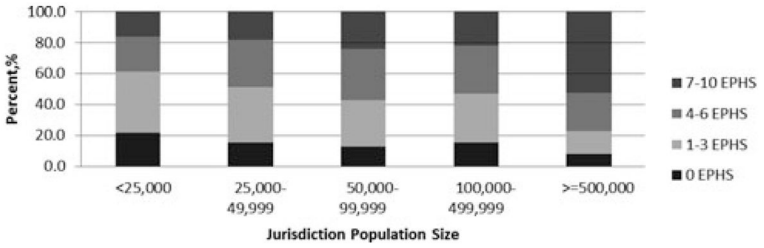

FIGURE 2.

Proportion of Local Health Departments Conducting Essential Public Health Services for Obesity Control in 2008 (by Population Size)

TABLE 1

Percentage of Local Health Departments Conducting the 10 EPHS for Obesity Control in 2005 and 2008

EPHS	2005 (n = 423) %[a] (95% CI)	2008 (n = 454) %[a] (95%CI)	Change From 2005 to 2008 %	*P*
0	27.9 (23.1–32.7)	17.0 (12.8–21.1)	− 10.9	<.001
1–3	30.9 (26.0–35.8)	34.7 (29.5–39.9)	3.8	.30
4–6	25.6 (21.0–30.1)	27.3 (22.6–32.0)	1.7	.59
7–10	15.6 (12.0–19.3)	21.0 (16.8–25.2)	5.4	.06
Mean[a]	3.05 (2.76–3.33)	3.69 (3.38–4.00)	0.64	.03

Abbreviations: CI, confidence interval; EPHS, essential public health services; LHD, local health department.

[a]Weighted estimate.

TABLE 2

Descriptive Statistics[a] of LHDs Conducting the 10 EPHS[b] for Obesity Control at LHDs in 2008

	EPHS 1		EPHS 2		EPHS 3		EPHS 4		EPHS 5		EPHS 7		EPHS 8		EPHS 9		EPHS 10	
Variables	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Population size (log), mean	10.80^{c}	10.28	10.92^{c}	10.27	10.77	10.04	10.99^{c}	10.08	11.06^{c}	10.29	10.75^{d}	10.31	10.80^{d}	10.42	11.05^{c}	10.39	10.73	10.51
Type of agency, %																		
City or township	12.30^{d}	25.66	13.80	22.69	13.42^{e}	31.14	14.85	23.25	13.03^{d}	21.82	13.41^{e}	25.09	16.51	20.17	17.78	19.37	22.42	18.45
Combined or multicounty	24.52	18.56	24.40	19.49	24.57	14.90	25.32	17.65	92.75	16.23	25.40	17.31	25.36	19.73	22.87	21.12	23.74	21.17
County	63.18	55.78	61.80	57.82	62.00	53.96	59.83	59.10	54.22	61.94	61.19	57.60	58.13	60.10	59.35	59.51	53.84	60.38
Local governance, %	81.00	80.99	80.84	81.12	79.47	84.37	76.99	85.13	80.44	81.27	78.89	83.30	79.49	81.71	83.62	80.20	83.73	80.57
Local board of health, %	80.71	79.07	79.81	79.93	79.23	81.31	75.58^{e}	84.18	71.63^{d}	83.80	76.57	83.47	75.03	82.04	76.54	80.90	87.40	78.79
Expenditure per capita (log), mean	3.73^{d}	3.45	3.69	3.52	3.69^{d}	3.37	3.70^{e}	3.48	3.76^{e}	3.51	3.71^{e}	3.46	3.71	3.54	3.78^{e}	3.54	3.69	3.58
FTE staff per 100 000 population (log), mean	3.91	3.75	3.90	3.78	3.94^{d}	3.58	3.88	3.78	3.90	3.80	3.94^{e}	3.72	3.90	3.80	3.88	3.82	4.01	3.80
Tenure of LHD director (y), mean	9.40^{e}	7.45	9.12	7.90	8.74	7.66	9.22	7.59	9.12	8.07	8.38	8.45	9.15	8.06	10.32^{e}	7.85	10.57	8.06
Full-time LHD director, %	92.75^{d}	82.88	92.54^{e}	84.36	92.45^{d}	77.39	93.54^{d}	81.74	94.86^{d}	84.30	93.58^{d}	81.56	93.00^{e}	85.34	96.04^{d}	85.30	85.39	88.15
Female LHD director, %	62.44	57.60	63.74	57.30	63.13	53.06	56.88	63.20	62.56	58.77	65.74^{e}	53.88	64.74	57.80	66.34	58.09	60.03	60.00
LHD director with graduate degree, %	65.69	58.18	66.26	58.72	63.51	57.99	70.41^{d}	53.16	66.43	59.70	62.28	61.31	65.25	60.29	71.03	59.04	55.72	62.72
Chronic disease control, %	48.80^{d}	31.55	52.55^{c}	31.25	46.03^{d}	27.42	44.86	35.45	50.04^{d}	35.39	44.46	35.60	49.23^{e}	35.92	57.49^{c}	34.82	48.87	38.80
Health assessment, %	85.00^{c}	47.62	81.92^{c}	55.11	73.56^{c}	50.37	81.27^{c}	50.93	83.21^{c}	58.14	74.06^{d}	57.94	84.43^{c}	57.82	78.14^{d}	62.77	86.47^{c}	63.18
Health improvement plan, %	68.84^{c}	32.15	69.39^{c}	37.22	60.37^{c}	28.32	68.91^{c}	31.66	74.02^{c}	39.21	60.87^{c}	38.97	77.89^{c}	38.23	68.03^{c}	45.01	71.47^{d}	47.30
Obesity prevalence in 2007, mean	28.11^{c}	26,68	27.71	27.18	27.53	27.11	27.79	27.00	27.37	27.41	27.84^{e}	26.93	27.27	27.46	27.10	27.49	27.49	27.39

Abbreviations: EPHS, essential public health services; FTE, full-time equivalent; LHD, local health department.

$^{*}P < .05$;

$^{**}P < .01$;

$^{***}P < .001$.

[a]Weighted estimates. Confidence intervals are not presented to simplify presentation.

[b] EPHS 6 "Enforcing laws and regulation" is not presented because sample size is too small.

[c] $p < .001$.

[d] $p < .01$.

[e] $p < .05$.

TABLE 3

Multivariate Logistic Regression Results of Factors Associated With the EPHS for Obesity Control[a] in 2008

	Odds Ratio (95% Confidence Interval)								
Variables	**EPHS 1**	**EPHS 2**	**EPHS 3**	**EPHS 4**	**EPHS 5**	**EPHS 7**	**EPHS 8**	**EPHS 9**	**EPHS 10**
Population size (log)	1.28 (0.99–1.65)	1.49[c] (1.14–1.95)	1.47[d] (1.09–1.98)	1.58[b] (1.21–2.05)	1.28 (0.97–1.68)	1.27 (0.97–1.66)	1.09 (0.83–1.42)	1.36[d] (1.03–1.79)	1.24 (0.88–1.76)
Type of agency (reference, county)									
City or township	0.72 (0.24–2.12)	1.50 (0.57–3.91)	0.52 (0.20–1.32)	1.28 (0.50–3.29)	1.28 (0.46–3.57)	1.11 (0.48–2.57)	1.58 (0.65–3.87)	1.74 (0.63–4.82)	1.92 (0.51–7.23)
Combined or multicounty	1.18 (0.57–2.44)	1.03 (0.50–2.12)	1.37 (0.60–3.13)	1.29 (0.60–2.79)	3.31[c] (1.47–7.43)	1.07 (0.52–2.22)	1.46 (0.63–3.40)	1.39 (0.58–3.29)	0.77 (0.24–2.46)
Local governance	3.23[c] (1.37–7.62)	1.48 (0.64–3.41)	1.64 (0.57–4.77)	1.24 (0.52–2.95)	3.21[c] (1.17–8.77)	2.05 (0.89–4.69)	1.44 (0.56–3.73)	3.39[d] (1.23–9.32)	0.82 (0.26–2.63)
Local board of health	1.21 (0.54–2.71)	1.50 (0.70–3.20)	1.15 (0.46–2.86)	0.89 (0.38–2.10)	0.39[d] (0.17–0.90)	0.64 (0.29–1.44)	0.75 (0.32–1.75)	0.88 (0.37–2.08)	1.76 (0.52–5.96)
Expenditure per capita (log)	1.67 (0.80–3.48)	1.32 (0.70–2.50)	0.92 (0.46–1.82)	1.06 (0.56–1.98)	2.45[c] (1.12–5.56)	1.76 (0.97–3.18)	1.10 (0.56–2.14)	2.21 (0.94–5.20)	1.28 (0.58–2.83)
FTE staff per 100 000 population (log)	0.93 (0.46–1.94)	1.00 (0.57–1.75)	2.11[d] (1.12–3.97)	1.29 (0.74–2.25)	0.72 (0.33–1.55)	0.93 (0.52–1.65)	1.19 (0.65–2.17)	0.67 (0.30–1.53)	1.35 (0.67–1.09)
Tenure of LHD director (y)	1.02 (0.97–1.06)	1.00 (0.96–1.04)	1.01 (0.96–1.05)	1.02 (0.98–1.07)	1.00 (0.96–1.05)	0.99 (0.95–1.03)	1.01 (0.96–1.05)	1.05[d] (1.00–1.09)	1.03 (0.98–2.31)
Full-time LHD director	2.18 (0.62–7.69)	1.40 (0.42–4.63)	1.12 (0.39–3.21)	1.71 (0.62–4.70)	2.80 (0.78–10.44)	2.57 (0.84–7.92)	2.97 (0.62–14.25)	1.69 (0.42–5.20)	0.53 (0.12–1.52)
Female LHD director	0.79 (0.40–1.57)	1.25 (0.65–2.38)	1.07 (0.51–2.24)	0.71 (0.37–1.36)	1.19 (0.60–2.39)	1.35 (0.74–2.45)	1.28 (0.64–2.56)	2.24[d] (1.14–4.42)	0.61 (0.24–1.14)
LHD director with graduate degree	1.04 (0.53–2.03)	1.07 (0.53–2.16)	1.17 (0.53–2.58)	1.31 (0.66–2.61)	0.95 (0.45–2.00)	0.76 (0.39–1.48)	0.96 (0.46–2.03)	1.25 (0.57–2.72)	0.40 (0.15–2.61)
Chronic disease control	1.44 (0.77–2.72)	1.67 (0.91–3.05)	1.07 (0.52–2.20)	0.80 (0.43–1.47)	1.37 (0.71–2.63)	1.16 (0.64–2.11)	1.37 (0.70–2.68)	1.74 (0.85–3.53)	1.14 (0.50–8.38)
Health assessment	3.20[c] (1.49–6.87)	1.24 (0.61–2.55)	0.97 (0.42–2.25)	2.33[d] (1.10–4.91)	1.42 (0.64–3.16)	0.75 (0.35–1.62)	1.86 (0.78–4.44)	0.70 (0.31–1.62)	2.04 (0.50–5.60)
Health improvement plan	2.54[c] (1.25–5.15)	2.57[c] (1.34–4.91)	4.36[b] (1.78–10.68)	2.99[c] (1.46–6.13)	3.77[b] (1.86–7.65)	2.49[d] (1.21–5.15)	3.53[b] (1.73–7.21)	2.26[d] (1.08–4.75)	1.86 (0.62–1.09)
Obesity prevalence in 2007	1.12[d] (1.02–1.22)	1.07 (0.98–1.16)	0.97 (0.88–1.07)	1.05 (0.97–1.14)	0.99 (0.91–1.09)	1.06 (0.97–1.14)	1.00 (0.92–1.08)	1.04 (0.95–1.15)	0.98 (0.88–1.09)

Abbreviations: EPHS, essential public health services; FTE, full-time equivalent; LHD, local health department.

[a]EPHS 6 “Enforcing laws and regulation” was not presented because the sample size is too small.

[b]$P < .001$.

[c]$P < .01$.

[d]$P < .05$.